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A LONGITUDINAL ASSESSMENT OF THE IMPACT OF HEALTH/FITNESS STATUS AND HEALTH BEHAVIOR ON PERCEIVED LIFE QUALITY

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Report No. 91-3

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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATE COVERED
	April 1991	Interim

4. TITLE AND SUBTITLE A Longitudinal Assessment of the Impact of Health/Fitness Status and Health Behavior on Perceived Quality of Life

5. FUNDING NUMBERS
Program Element: 63706N
Work Unit Number:
M0095.005-6106 & BuPers Reimbursable

6. AUTHOR(S)
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P. O. Box 85122
San Diego, CA 92186-5122

8. PERFORMING ORGANIZATION
Report No. 91-3

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Naval Medical Research and Development Command
National Naval Medical Center
Building 1, Tower 2
Bethesda, MD 20889

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Published In: Perceptual and Motor Skills, 1992, 75, 3-14

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

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14. SUBJECT TERMS
Health Behavior
Health Status
Quality of Life
Navy men and women
Physical fitness

15. NUMBER OF PAGES
13

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

Perceptual and Motor Skills, 1992, 75, 3-14.

A LONGITUDINAL ASSESSMENT OF THE IMPACT OF HEALTH/FITNESS STATUS AND HEALTH BEHAVIOR ON PERCEIVED QUALITY OF LIFE[1,2]

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Summary.—This study extended cross-sectional research associating quality of life with health and fitness factors. Longitudinal analyses were performed on data collected from 519 U.S. Navy personnel to assess changes in quality of life with changes in health/fitness status and health behavior dimensions at 1-yr. and 2-yr. intervals. Multiple regression results showed that such changes were positively associated with changes in health/fitness status and behaviors related to accident control and wellness maintenance, with these predictors accounting for 8% of the variance in change in quality of life at the 1-yr. interval. At the 2-yr. interval, such change was associated with health/fitness status and accident control behaviors, accounting for 11% of the variance. Health behavior change made a unique contribution to change in quality of life after controlling for changes in health/fitness status at both intervals. Findings affirm modest yet consistent associations between changes in fitness and health variables and quality of life and suggest that improvements in health behavior influence quality of life independently of one's health/fitness status.

In recent years, the U.S. Navy has established large-scale programs designed to promote physical fitness and positive health practices among its members (Department of the Navy, 1986). Fitness and health issues are being emphasized because they have potential impact on Navy readiness as well as on the over-all quality of life and well-being of the service member. This approach is based on an implied model which assumes that health behaviors impact health status, which in turn influences quality of life.

Support can be found for subsets of this hypothetical model. For example, investigations into the relationship between health behavior and health status have advanced the notion that, more than any other factor, health behavior has a substantial and direct effect on health status (Slater & Carlton, 1985). Although most studies in this area were not designed to confirm health behavior as a causative factor influencing health status, the cross-sectional findings are supportive. Several health and fitness-related behaviors (e.g., moderate drinking, smoking abstinence, physical activity, weight con-

[1]Based on Naval Health Research Center Technical Report No. 91-3. The views presented are those of the authors and do not reflect the official policy of the Department of the U.S. Navy, Department of Defense, or the U.S. government. This work was supported by the Naval Military Personnel Command under Work Order No. N0002291WRWW549 and by the Naval Medical Research and Development Command, Work Unit No. 63706NM0095.005-6106, Department of the Navy.

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trol, adequate sleep, and seat belt use) have been reliably associated with higher subjective and functional health status (Rakowski, 1986; Stephens, 1986; Brock, Haefner, & Noble, 1988; Segovia, Bartlett, & Edwards, 1989).

A second relational component of this model, the impact of health status on over-all quality of life, has also been examined. Several studies, usually using community samples, have found that physical health and measures of psychological well-being are strongly correlated (Mechanic, 1980; Andrews, Tennant, Hewson, & Schonell, 1978; Frericks, Aneshensel, Yokopenic, & Clark, 1982; Schwab, Traven, & Warheit, 1978; Neff, Baqar, & McCorkel, 1980; Kathol & Petty, 1981). Likewise, a relationship between positive health/fitness status and quality of life was reported in a large study of U.S. Navy shipboard men (Woodruff & Conway, 1990). Another recent Navy study that included a replication sample found that health behaviors contributed uniquely to the prediction of quality of life after controlling for health and fitness status (Woodruff & Conway, in press).

Results thus far, while consistent across studies, have been based primarily on cross-sectional data. A logical extension of previous work would include the use of repeated measurements of quality of life, health behaviors, and health and fitness status to examine the health-quality of life association over time; that is, are changes in perceived quality associated with changes in health and fitness? Longitudinal assessments control for spurious effects due to unobserved respondents' characteristics which are assumed to remain more or less constant over the course of the study. For this reason, longitudinal data are generally considered preferable to cross-sectional data because they provide more accurate and reliable assessments of dynamic behavior and change over time (Lillard, 1989; Rodgers, 1989).

The purpose of the present study was to extend previous cross-sectional findings by examining longitudinally the relationship between health/fitness variables and perceived quality of life. More specifically, we examined the degree to which changes in quality of life are associated with changes in health/fitness status and health behavior at both 1-year (1986–1987) and 2-year (1986–1988) intervals.

Method

Participants

Participants were 519 U.S. Navy personnel who were part of a large sample randomly selected in 1986 to take part in a study examining life-style habits and attitudes toward health and fitness. These 519 individuals were examined because they provided data for three consecutive years during the study. The demographic composition of the 519 participants was similar to that of the over-all U.S. Navy, consisting of 89.3% men and 10.7% women. The average age was 29 years ($SD = 6.7$) with a range from 17 to 52 years.

Race composition was 89% white, 11% black, and less than 1% from other racial groups. Ninety-four percent of the participants had at least 12 years of education, a percent identical to the over-all U.S. Navy. Enlisted personnel comprised 89.9% and officers 10.1% of the participating group, again reflecting percentages very similar to the U.S. Navy at large.

Procedure and Measures

Participants completed self-report questionnaires during 1986, 1987, and 1988 that included assessments of life quality, health and fitness status, and health behaviors. Command Fitness Coordinators (CFCs), who are U.S. Navy personnel assigned by each command to conduct mandatory physical fitness testing, distributed and collected questionnaires from the participants in 1986. In 1987 and 1988, CFCs distributed the questionnaires to individual participants who then completed and returned the questionnaires to the researchers in postage-free envelopes.

Over-all Quality of Life.—Participants completed 14 items adapted from those developed by Caplan, Abbey, Abramis, Andrews, Conway, and French (1984). These items, presented in Appendix A (p. 13), assessed life satisfaction/positive affect in a variety of areas such as personal accomplishments, interpersonal relationships, work, and life as a whole. Wording of these items was based on that originally used by Andrews and Withey (1976). Item responses were presented in a 7-point scale in Likert format with response choices being terrible (1), unhappy (2), mostly dissatisfied (3), mixed (4), mostly satisfied (5), pleased (6), or delighted (7).

In the present study, a measure of Over-all Quality of Life was used rather than measures related to separate life domains. According to theories of perceived life quality, assessments of over-all quality are a function of quality of life in particular domains (e.g., work, personal life); therefore, combining domain assessments into an over-all measure has theoretical merit (Caplan, *et al.*, 1984). Furthermore, a previous study reported a relatively similar set of health predictors for four domain-specific measures of quality (Woodruff & Conway, 1990). For these reasons and for the sake of simplicity, a measure of Over-all Quality of Life was computed as a mean of the 14 items. The internal consistency (Cronbach's alpha averaged across the three years) of this scale was .91.

Health/Fitness Status.—Self-reported Health/Fitness Status was based on a four-item scale. Two items asked participants to rate their current health and their current physical fitness on a 5-point scale ranging from poor (1) to excellent (5). Two other items asked about the extent to which one's physical fitness and one's health had been what he/she wanted it to be. A 5-point scale was used which ranged from not at all (1) to a great deal (5). The 3-year averaged Cronbach's alpha for this scale was .83.

Health Behavior Checklist dimensions.—The life-style questionnaire in-

cluded a Health Behavior Checklist consisting of a sample of 40 items thought to represent major health behavior groupings (Vickers, Conway, & Hervig, 1990). Participants indicated how well each of the specific health practices described usual behavior using response options ranging from not at all like me (1) to very much like me (5). Because health behaviors are known to be multidimensional (most estimates range from two to five dimensions), 28 of the 40 items were combined to form four scales representing the dimensions of health behavior found by Vickers, *et al.* (1990). These four dimensions are briefly described below, and the specific items comprising each dimension can be found in Appendix B (p. 14). Scores were computed as the mean of the responses for items within each dimension.

Broadly speaking, the Wellness Maintenance and Enhancement dimension (averaged $\alpha = .79$) represents actions that, if taken, could maintain or improve health. Traffic Risk (averaged $\alpha = .78$) represents behaviors that involve risk taking, primarily as a pedestrian or driver. Accident Control (averaged $\alpha = .71$) encompasses behaviors related to avoiding or minimizing the effects of accidents and injuries. The fourth health behavior dimension, Substance Risk (averaged $\alpha = .30$), identifies behaviors pertaining to the use of substances that may adversely affect one's health (e.g., tobacco, alcohol, chemical substances). The poor internal consistency of this last dimension is not surprising in light of the few number of items and the heterogeneous nature of the items in this scale. The lower coefficient alpha for this scale relative to the other three was also seen during development of the health behavior dimensions (Vickers, *et al.*, 1990).

Change Analyses

To analyze associations between 1-year and 2-year changes in Quality of Life with changes in Health/Fitness Status and Health Behavior, residualized gain scores for Quality of Life, Health/Fitness Status, and the Health Behavior scales were computed for the 1986–1987 1-yr. interval and the 1986–1988 2-yr. interval. With this method of measuring change, a "gain" (i.e., change) is residualized by expressing a Time 2 score as a deviation from the Time 2-on-Time 1 regression line. The part of the Time 2 information that is predictable from the Time 1 score is thus partialled out. Residualized gain scores are generally considered superior to raw gain scores formed by subtracting Time 1 scores from Time 2 scores because they are not as sensitive to the effects of measurement error.

More specifically, residualized gain scores for both time intervals were computed by first conducting individual regressions predicting Time 2 scores for Health/Fitness Status, Health Behavior scales, and Quality of Life from their respective Time 1 scores. (For the 1-yr. interval, Time 1 refers to 1986 scores and Time 2 refers to 1987 scores; for the 2-yr. interval, Time 1 scores refer to 1986 scores and Time 2 scores refer to 1988 scores.) A residualized

gain score for each person was then computed as the difference between the actual Time 2 score and the predicted Time 2 score. Next, another regression procedure was conducted to predict the residualized gain scores for Quality of Life from the Health/Fitness Status and Health Behavior residualized gain scores. Health/Fitness Status residualized gain scores were forced to enter this regression equation first; at the next stage, the four Health Behavior residualized gain scores were entered. This forced-entry method made it possible to assess the independent associations between variations in Quality of Life over time with Health/Fitness Status and Health Behavior changes, and also to assess the additional contribution of Health Behavior change after controlling for Health/Fitness Status changes.

Results and Discussion

Means, standard deviations, and bivariate correlations among the variables are provided in Table 1. Results of regression analyses (Table 2) indicated that 1-year changes in Quality of Life were positively and uniquely associated with changes in Health/Fitness Status and with two Health Behavior scales, Accident Control and Wellness Maintenance and Enhancement. These three predictors accounted for 8% of the variance in change in Quality of Life over the 1986-to-1987 interval. Change in Health/Fitness Status contributed 4% to change in Quality of Life, and the two Health Behavior scales contributed another 4%.

Considering the 1986-to-1988 interval, changes in quality of life were significantly related to 2-year changes in Health/Fitness Status and the Health Behavior scale Accident Control. These two predictors accounted for 11% of the variance in quality of life at the 2-yr. interval. Health/Fitness Status and Accident Control variables contributed 9% and 2%, respectively.

This study examined longitudinal data to investigate further the linkages among subjective quality of life, health, and fitness. Consistent with previous cross-sectional research (Woodruff & Conway, in press), results of this longitudinal investigation affirmed a small yet highly consistent association between changes in quality of life and changes in self-reported fitness and health status. Furthermore, changes in health behaviors, particularly those related to controlling accidents and injuries, made an independent contribution to change in Quality of Life after controlling for perceived health/fitness status. In addition, behaviors related to maintaining and enhancing health were also implicated as potentially important behaviors influencing change in quality of life; however, this association needs further investigation as it was found at only the 1-yr. interval. While the unique contributions of changes in health/fitness status and health behavior to quality of life were modest, the similar pattern of associations demonstrated at both the 1-yr. and 2-yr. intervals is noteworthy.

Results of the present longitudinal study underscore the importance of

TABLE 1

MEANS AND ZERO-ORDER CORRELATIONS AMONG HEALTH/FITNESS STATUS, HEALTH BEHAVIOR SCALES, AND OVER-ALL QUALITY OF LIFE FOR A U.S. NAVY SAMPLE DURING 1986, 1987, AND 1988

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	M	3.37	3.40	3.46	2.57	2.51	2.49	3.51	3.59	3.60	2.93	2.80	2.68	2.87	2.98	3.04	5.45	5.37	5.42
	SD	.72	.75	.76	.77	.77	.77	.81	.78	.79	.93	.81	.77	.75	.72	.72	.78	.80	.78
1.	H/F1																		
2.	H/F2	.576†																	
3.	H/F3	.472†	.613†																
4.	TR1	.091	.143*	.001															
5.	TR2	.035	.082	−.033†	.724†														
6.	TR3	.015	.059	-.042	.672*	.745†													
7.	AC1	.192†	.094	.165†	−.259†	−.201†	−.226†												
8.	AC2	.112	.060	.152†	−.178†	−.208†	−.201†	.674†											
9.	AC3	.152†	.058	.154†	−.225†	−.219†	−.236†	.634†	.722†										
10.	SR1	−.217†	−.167†	−.179†	.076	.033	.080	−.173†	−.123*	−.116*									
11.	SR2	−.161†	−.080	−.091	.218†	.207†	.188†	−.124*	−.147†	−.206†	.600†								
12.	SR3	−.190†	−.185†	−.147†	.120*	.136*	.243†	−.090	−.150†	−.208†	.540†	.674†							
13.	WM1	.235†	.172†	.230†	−.151†	−.149†	−.129*	.433†	.361†	.372†	−.266†	−.238†	−.213†						
14.	WM2	.216†	.237†	.237†	−.125*	−.166†	−.126*	.354†	.469†	.383†	−.239†	−.283†	−.295†	.745†					
15.	WM3	.186†	.171†	.339†	−.178†	−.199†	−.165†	.380†	.388†	.512†	−.163†	−.250†	−.303†	.718†	.731†				
16.	QOL1	.351†	.250†	.203†	−.157†	−.195†	−.232†	.306†	.279†	.315†	.048	−.045	−.020	.160†	.184†	.198†			
17.	QOL2	.291†	.340†	.306†	−.012	−.109	−.109	.220†	.270†	.279†	.025	−.023	−.030	.105	.206†	.136*	.546†		
18.	QOL3	.269†	.253†	.355†	−.120*	−.149†	−.215†	.274†	.260†	.325†	−.019	−.059	−.091	.163†	.167†	.228†	.572†	.664†	

Note.—H/F1 = Health/Fitness Status, 1986; H/F2 = Health/Fitness Status, 1987; H/F3 = Health/Fitness Status, 1988; TR1 = Traffic Risk, 1986; TR2 = Traffic Risk, 1987; TR3 = Traffic Risk, 1988; AC1 = Accident Control, 1986; AC2 = Accident Control, 1987; AC3 = Accident Control, 1988; SR1 = Substance Risk, 1986; SR2 = Substance Risk, 1987; SR3 = Substance Risk, 1988; WM1 = Wellness Maintenance & Enhancement, 1986; WM2 = Wellness Maintenance & Enhancement, 1987; WM3 = Wellness Maintenance & Enhancement, 1988; QOL1 = Quality of Life, 1986; QOL2 = Quality of Life, 1987; QOL3 = Quality of Life, 1988.

*$p < .01$. †$p < .001$.

accident/injury prevention practices and, to a lesser extent, behaviors related to maintaining health as important behavioral domains influencing change in quality of life. In their article, Vickers, *et al.* (1990) proposed a hierarchical model of health behavior in which Accident Control and Wellness Maintenance behaviors were treated as indicators of a more general dimension, Preventive Health. It might be speculated that engaging in preventive health behaviors results in a decrease in accidents and illness, thereby having a tangible effect on life satisfaction. Psychological and social variables may also be involved to the extent that changes in the performance of preventive behaviors may bring about changes in the quality-of-life-related outcomes, such as greater perceived control and social approval. Valuable future work in this area might explore possible processes or mechanisms that can account for changes in quality of life associated with changes in particular health behavior areas.

TABLE 2

RESULTS OF MULTIPLE REGRESSION ANALYSES PREDICTING CHANGES IN QUALITY OF LIFE FROM CHANGES IN HEALTH/FITNESS STATUS AND HEALTH BEHAVIOR IN A U.S. NAVY SAMPLE

Residualized Gain Predictors		Regression Statistics	
		1-yr. Interval 1986–1987	2-yr. Interval 1986–1988
Health/Fitness Status	beta	.183†	.289†
	R	.21	.30
	R^2	.04	.09
	$R^2\Delta$	.04†	.09*
Health Behavior			
Traffic Risk	beta	−.072	−.079
Accident Control	beta	.096*	.109*
Substance Use	beta	.020	−.021
Wellness Maintenance & Enhancement	beta	.100*	−.017
	R	.27	.33
	R^2	.08	.11
	$R^2\Delta$	.04*	.02*

*$p < .05$. †$p < .001$.

The application of change analyses in the present study proved useful in investigating health factors associated with longitudinal variations in quality of life. Residualized gain analysis provided the opportunity to examine whether changes in quality of life were related to changes in health and fitness measures. Conducting this type of analysis rather than simply cross-sectionally relating quality of life to health/fitness provided a methodological control for variability due to individual differences that are constant over time (Kalton, 1989).

However, while longitudinal studies offer certain benefits over cross-sectional investigations, such studies also have limitations. Longitudinal anal-

yses provide stronger support for causal hypotheses, yet do not unequivocally prove the existence of a cause and effect relationship between variables (Davis, 1985). As in the case of cross-sectional analyses, causal interpretations using longitudinal data depend on the application of a theoretical model (Rodgers, 1989). In the present study, the causal assumption was that better health and fitness status and more positive health behaviors will produce higher quality of life. While this assumption may be valid, longitudinal analyses provide only moderate support for causal theories and cannot rule out alternative explanations of the results.

A possible limitation of the present study is attributable to the use of self-report measures for all of the constructs of interest. Part of the variance in quality of life explained by health status and health behavior could, therefore, be from common method variance. Individuals who are inclined to respond positively to one self-report variable may be generally inclined to respond similarly to other self-report variables. This tendency toward consistency in self-reporting can enhance correlation coefficients and subsequently account for false relationships (Spector, 1982). Furthermore, self-report health assessments are generally thought to be less accurate than clinical assessments (Dean, 1988; Abramson, 1984). Despite the discrepancies, however, self-reports of health status and related behavior provide useful qualitative information that is predictive of subsequent health (Abramson, 1984) and psychological outcomes.

Additional longitudinal studies would be useful for developing a knowledge base of subjective quality of life and its health-related correlates. This study used a measure of over-all quality of life because of theoretical and practical considerations as well as the results of a previous study (Woodruff & Conway, 1990). However, additional work is warranted to test our assumptions about the utility of an over-all measure of quality of life versus domain-specific scales. While findings presented here and in previous studies show consistent associations between health and quality of life, replication studies in non-Navy populations are needed to test the generalizability of the findings reported here to other sociodemographic groups. In addition, studies using both subjective and objective sources of health information could help circumvent some of the methodological issues related to using only self-report measures. Finally, a two-group pretest-posttest intervention study would add much toward demonstrating the causal effects of health-related variables on quality of life.

In conclusion, findings indicate that changes in self-reported health/fitness status are positively associated with changes in perceived quality of life over both 1- and 2-yr. periods. Further, health behavior changes, particularly those related to accident prevention, predicted quality of life independently of changes in health and fitness status. Although the contributions of health-

related predictors were modest, they have implications for existing U.S. Navy health promotion interventions aimed at improving accident-related and life-style behaviors (e.g., increasing exercise, improving diet, establishing better safety practices). To the extent that these programs are effective in changing behavior and enhancing health status, they may serve to enhance perceived quality of life as well.

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Accepted May 26, 1992.

APPENDIX A

Quality-of-life Items

1. How do you feel about your own personal life?
2. How do you feel about your wife/husband (or girlfriend/boyfriend)?
3. How do you feel about your romantic life?
4. How do you feel about your job?
5. How do you feel about the people you work with—your coworkers?
6. How do you feel about the work you do on the job—the work itself?
7. How do you feel about the way you handle problems that come up in your life?
8. How do you feel about what you are accomplishing in your life?
9. How do you feel about your physical appearance—the way you look to others?
10. How do you feel about yourself?
11. How do you feel about the extent to which you can adjust to changes in your life?
12. How do you feel about your life as a whole?
13. Considering all things together, how content are you with your life as a whole?
14. To what extent has your life as a whole been what you wanted it to be?

APPENDIX B

Health Behavior Dimensions

Wellness Maintenance and Enhancement

1. I see a doctor for regular checkups.
2. I exercise to stay healthy.
3. I gather information on things that affect my health by watching television and reading.
4. I see a dentist for regular checkups.
5. I discuss health with friends, neighbors, and relatives.
6. I limit my intake of foods like coffee, sugar, fats, etc.
7. I use dental floss regularly.
8. I watch my weight.
9. I take vitamins.
10. I take health food supplements (e.g., protein additives, wheat germ, bran, lecithin).

Traffic Risk

1. I cross busy streets in the middle of the block.
2. I take more chances doing things than the average person.
3. I speed while driving.
4. I take chances when crossing the street.
5. I carefully obey traffic rules so I won't have accidents. (reversed)
6. I cross the street against the light.
7. I engage in activities or hobbies where accidents are possible (e.g., motorcycle riding, skiing, using power tools, sky or skin diving, hang gliding, etc.).

Accident Control

1. I keep emergency numbers near the phone.
2. I destroy old or unused medicines.
3. I have a first aid kit in my home.
4. I check the condition of electrical appliances, the car, etc. to avoid accidents.
5. I fix broken things around my home right away.
6. I learn first aid techniques.

Substance Risk

1. I do not drink alcohol. (reversed)
2. I don't take chemical substances which might injure my health (e.g., food additives, drugs, stimulants). (reversed)
3. I don't smoke. (reversed)
4. I avoid areas with high pollution. (reversed)